

What is claimed is:

1. A forming method of a resist pattern, comprising:

(a) carrying out a heat treatment of a substrate, on which a resist pattern is formed, in a first heat treatment temperature in a first treatment period; and

5 (b) changing said first heat treatment temperature to a second heat treatment temperature during said heat treatment such that a variation of dimensions of said resist pattern in said heat treatment reaches a desirable variation in a second
10 treatment period.

2. The forming method according to claim 1, wherein said (b) comprises:

(b1) calculating said second heat treatment temperature based on said desirable variation and said
5 variation in said first heat treatment temperature; and

(b2) carrying out said heat treatment of said substrate in said second heat treatment temperature in said second treatment period.

3. The forming method according to claim 2, wherein said (b1) comprises:

(b11) calculating said variation based on a substantial temperature of said substrate, said first
5 treatment period and a temperature dependence data

which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern.

4. The forming method according to claim 3, wherein said (b1) comprises:

(b12) calculating said second heat treatment temperature based on a required variation which is a
5 difference between said desirable variation and said variation in said first heat treatment temperature, said temperature dependence data and said second treatment period.

5. The forming method according to claim 1, wherein said (a) comprises:

(a1) carrying out said heat treatment in said first heat treatment temperature in each of a
5 plurality of areas in said substrate in said first treatment period independently,

said (b) comprises:

(b3) changing said first heat treatment temperature to said second heat treatment temperature
10 during said heat treatment such that said variation reaches said desirable variation in said second treatment period in said each of a plurality of areas.

6. The forming method according to claim 5, wherein

said (b3) comprises:

(b31) calculating said second heat treatment temperature based on said desirable variation and said variation in said first heat treatment temperature in
5 said each of a plurality of areas; and

(b32) carrying out said heat treatment of said substrate at said second heat treatment temperature in said second treatment period in said each of a
10 plurality of areas.

7. The forming method according to claim 6, wherein said (b31) comprises:

(b311) calculating said variation based on a substantial temperature of said substrate, said first
5 treatment period and a temperature dependence data which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern in said each of a plurality of said areas.

8. The forming method according to claim 7, wherein said (b31) comprises:

(b312) calculating said second heat treatment temperature based on a required variation which is a
5 difference between said desirable variation and said variation in said first heat treatment temperature, said temperature dependence data and said second

treatment period in said each of a plurality of said areas.

9. A computer program product embodied on a computer-readable medium and comprising code that, when executed, causes a computer to perform the following:

5 (a) carrying out a heat treatment of a substrate, on which a resist pattern is formed, in a first heat treatment temperature in a first treatment period; and

(b) changing said first heat treatment temperature to a second heat treatment temperature
10 during said heat treatment such that a variation of dimensions of said resist pattern in said heat treatment reaches a desirable variation in a second treatment period.

10. The computer program product according to claim 9, wherein said (b) comprises:

(b1) calculating said second heat treatment temperature based on said desirable variation and said
5 variation in said first heat treatment temperature; and

(b2) carrying out said heat treatment of said substrate in said second heat treatment temperature in said second treatment period.

11. The computer program product according to claim 10, wherein said (b1) comprises:

(b11) calculating said variation based on a substantial temperature of said substrate, said first
5 treatment period and a temperature dependence data which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern.

12. The computer program product according to claim 11, wherein said (b1) comprises:

(b12) calculating said second heat treatment temperature based on a required variation which is a
5 difference between said desirable variation and said variation in said first heat treatment temperature, said temperature dependence data and said second treatment period.

13. The computer program product according to claim 9, wherein said (a) comprises:

(a1) carrying out said heat treatment in said first heat treatment temperature in each of a
5 plurality of areas in said substrate in said first treatment period independently,

said (b) comprises:

(b3) changing said first heat treatment temperature to said second heat treatment temperature

10 during said heat treatment such that said variation reaches said desirable variation in said second treatment period in said each of a plurality of areas.

14. The computer program product according to claim 13, wherein said (b3) comprises:

(b31) calculating said second heat treatment temperature based on said desirable variation and said
5 variation in said first heat treatment temperature in said each of a plurality of areas; and

(b32) carrying out said heat treatment of said substrate at said second heat treatment temperature in said second treatment period in said each of a
10 plurality of areas.

15. The computer program product according to claim 14, wherein said (b31) comprises:

(b311) calculating said variation based on a substantial temperature of said substrate, said first
5 treatment period and a temperature dependence data which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern in said each of a plurality of said areas.

16. The computer program product according to claim 15, wherein said (b31) comprises:

(b312) calculating said second heat treatment temperature based on a required variation which is a difference between said desirable variation and said variation in said first heat treatment temperature, said temperature dependence data and said second treatment period in said each of a plurality of said areas.

17. A heat treatment apparatus comprising:

a plurality of heat treatment sections each of which separately carries out a heat treatment of corresponding one of a plurality of areas in a substrate having a resist pattern;

a plurality of temperature sensors each of which detects a temperature of corresponding one of said plurality of heat treatment sections; and

a control section which controls each of said plurality of heat treatment sections based on corresponding one of each of detection results,

wherein said control section calculates a variation of dimensions of said resist pattern in said heat treatment in a first heat treatment temperature in a first treatment period based on said first heat treatment temperature, and changes said first heat treatment temperature to a second heat treatment temperature such that said variation reaches a desirable variation in said each of a plurality of

20 areas in a second treatment period, during said heat treatment.

18. The heat treatment apparatus according to claim 17, wherein said control section calculates said second heat treatment temperature based on said desirable variation and said variation in said first
5 heat treatment temperature in said first treatment period in said each of a plurality of said areas, and carries out said heat treatment of said substrate in said second heat treatment temperature in said second treatment period in said each of a plurality of said
10 areas.

19. The heat treatment apparatus according to claim 18, wherein said control section calculates said variation based on a temperature at a place beside said substrate, said first treatment period and a
5 temperature dependence data which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern in said each of a plurality of said areas.

20. The heat treatment apparatus according to claim 19, wherein said control section calculates said second heat treatment temperature based on a required variation which is a difference between said desirable

5 variation and said variation in said first heat treatment temperature, said temperature dependence data and said second treatment period in said each of a plurality of said areas.

21. A manufacturing method of a semiconductor apparatus, comprising:

(c) forming a resist pattern on a substrate on which a film is formed;

5 (d) carrying out a heat treatment of said substrate in a first heat treatment temperature in a first treatment period;

(e) changing said first heat treatment temperature to a second heat treatment temperature during said heat treatment such that a variation of dimensions of said resist pattern in said heat treatment reaches a desirable variation in a second treatment period;

(f) etching said film on said substrate; and

15 (g) removing said resist pattern from said substrate.

22. The manufacturing method according to claim 21, wherein said (e) comprises:

(e1) calculating said second heat treatment temperature based on said desirable variation and said variation in said first heat treatment temperature;

and

(e2) carrying out said heat treatment of said substrate in said second heat treatment temperature in said second treatment period.

23. The manufacturing method according to claim 22, wherein said (e1) comprises:

(e11) calculating said variation based on a substantial temperature of said substrate, said first
5 treatment period and a temperature dependence data which shows a relation between heat treatment temperatures and variation rates per unit of time of dimensions of said resist pattern.

24. The manufacturing method according to claim 23, wherein said (e1) comprises:

(e12) calculating said second heat treatment temperature based on a required variation which is a
5 difference between said desirable variation and said variation in said first heat treatment temperature, said temperature dependence data and said second treatment period.